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(54) AXIAL FAN

(57) An axial fan having a stator (1) to which is attached a rotor with at least two blades (4) having a geometry for moving air in a direction. To the ends of at least two blades (4) is attached a rotating ring on the outer side of which there are at least two other blades (6) and at the ends of the other blades (6) there is an outer shell (10), wherein to the stator (1) by means of at least one rib (7) there is rigidly attached by its inner part a static circular shell (8) adjacent to the rotating ring. A circular outer shell (10) is rigidly attached to the outer part of the ring by means of at least one separating rib (9) in its inner part, and another static circular shell is rigidly attached by its outer part to the inner part of the circular shell (10) behind the outer blades (6) by means of at least one additional separating rib.

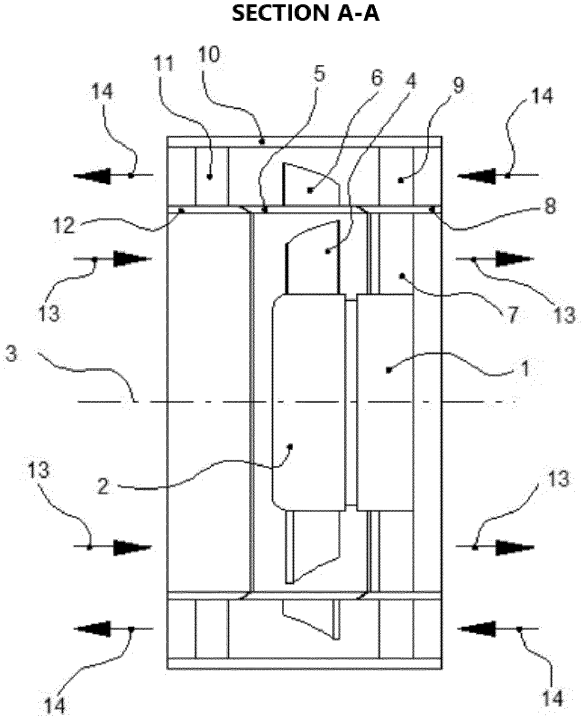


Fig. 2

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SECTION B-B

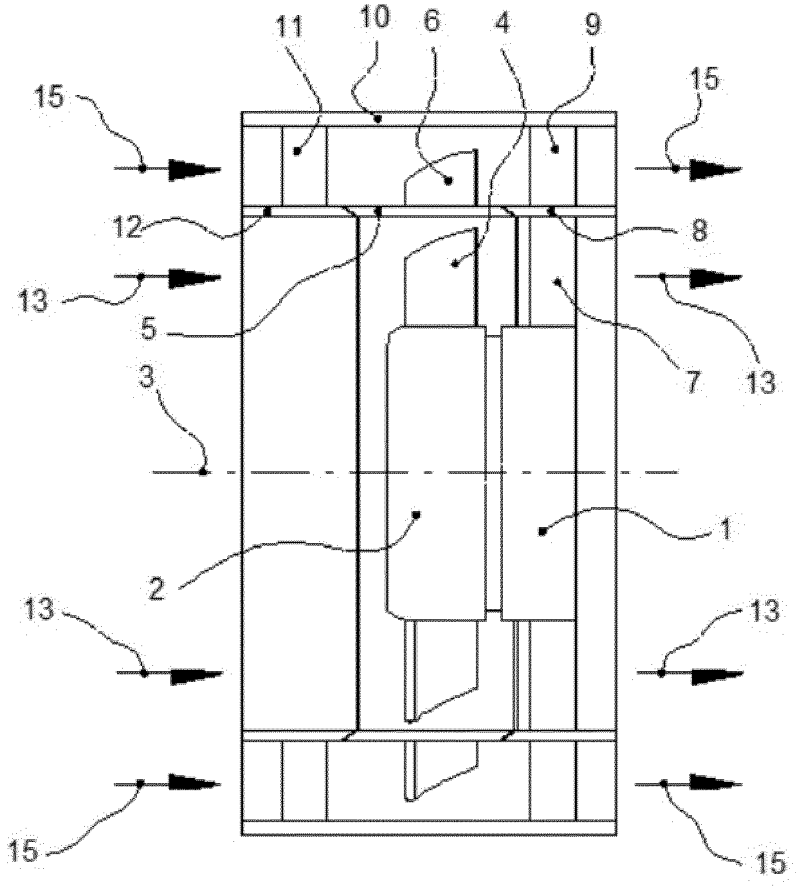


Fig. 5

Description

Technical Field

[0001] The technical solution relates to an axial fan consisting of a single drive-torque source, such as an electric motor, internal combustion engine, turbine, etc., providing rotary motion of the active blades. It is a fan for various applications, for example, for the removal of pollutants, heat, and moisture from the interior of residential, commercial, and industrial facilities such as electrical switchboard cabinets and cabinets with electronic components, or to provide the necessary airflow, i.e. gases and vapours, in various industries.

Background Art

[0002] In technical practice, there are many types of axial fans driven by a single torque source. Usually these are single current, i.e. unidirectional fans. This means that the air is drawn in from one side of the axial fan and expelled on the other side of the axial fan.

[0003] For example, if it is necessary to bring fresh air into a room with an axial fan and at the same time remove polluted air from the room, two separate axial fans are usually used.

[0004] The disadvantages of this solution are the higher costs of two fans, the greater labour required to install two separate fans, the greater space requirements for placement, and the greater demands on electrical connections.

[0005] Typically, a single axial fan used to extract polluted air from, for example, the kitchen and/or bathroom and/or sanitary facilities requires air to be drawn in from adjacent rooms. This uncontrolled airflow can cause unwanted airflow in adjacent spaces, whether for energy, hygiene or other reasons, or insufficient airflow due to windows and doors being too tight.

[0006] If it is necessary to convey air at a temperature that adversely affects the lifetime of the drive-torque source, such as an electric motor, known engineering solutions must be used to prevent direct contact between the fluid and the drive-torque source.

[0007] The disadvantages of these solutions are higher costs and greater space requirements for more complex technical solutions, for example by using an additional, separate, self-propelled air flow source.

Summary of the Invention

[0008] The above shortcomings are largely eliminated by an axial fan equipped with a single drive - a torque source such as an electric motor and the like. The rotating part of the drive is rigidly connected to the inner rotating blades, closer from the axis of rotation, ensuring the flow of air in one direction according to the presented technical solution. Its essence is that the ends of the inner rotating blades are rigidly connected by their inner side to a ring, the outer side of which is rigidly connected to outer blades rotating in the same direction, farther from the axis of rotation, which ensure the coaxial flow of air in the opposite or the same direction as the inner rotating blades.

[0009] The number of one-way rotating inner and outer blades can be the same or different. The number and geometry of the blade shape according to known technical solutions is such as to ensure coaxial parallel flow or coaxial counterflow of a fluid in the necessary directions with the necessary aerodynamic properties.

[0010] The advantage of this solution is the use of a single drive-torque source, for at least two ring-separated air flows, which are provided by inner and outer blades in two co-current or counter-current coaxial directions.

[0011] To prevent the two coaxial fluid flows from mixing, static rings are attached to the rotating ring in both directions, separated by a suitably shaped slit with a minimum width to minimize the mixing of the two air flows. The outer, static portion of the axial fan with a circular opening is suitably rigidly connected by at least one support rib to each of the two static rings adjacent to the rotating ring and a central rigid portion which carries the static portion of the torque source to allow fluid to flow in two co-current or counter-current coaxial directions to the maximum extent possible.

[0012] This technical design of the axial fan, where two separate coaxial air flows have opposite directions, can be used, for example, for ventilation-air exchange of interior residential, commercial, and industrial spaces, as well as spaces of industrial equipment such as electrical switchboard cabinets, cabinets with electronic components, for removal of heat, possibly cold and the like. Due to the use of a single torque source for the fan providing two separate air flows in the coaxial direction, maintenance, commissioning and plant space requirements are significantly reduced compared to using two separate unidirectional axial fans to provide supply and exhaust of air.

[0013] This technical solution of the axial fan, where two separate coaxial flows of air have the opposite or the same direction, can be used, for example, to transport air that thermally or chemically burdens the drive of the axial fan. In this case, only the outer blades, which are not directly connected to the drive of the axial fan, would give momentum to the air flow that could impose a temperature or chemical load on the fan drive.

[0014] The coaxial inter-annular cross-sections on the intake and discharge sides of the fan may be suitably connected to a coaxial, double duct of the required length and/or a component to heat or cool the required air flow and/or a device to recover heat or cold between the air flows and/or a component to filter impurities in the air flow and/or a component to partially or fully enclose the air flow and/or a distribution element to prevent mixing of the two air flows in the vicinity of this distribution element.

[0015] The momentum of the air flow in one direction can be used for its controlled distribution in the ventilated space while extracting polluted air from the enclosed

space in the other, opposite direction.

Brief Description of the Drawings

[0016] The axial fan of this technical solution will be described in more detail on specific examples of embodiments using the accompanying drawings, where Fig. 1 shows an exemplary axial fan in the direction of the rotation axis with inner and outer blades producing the opposite directions of air flow. Fig. 2 shows a section of the axial fan shown in Fig. 1. Fig. 3 is an axonometric view of the fan shown in Fig. 1. Fig. 4 shows an exemplary axial fan in the direction of the rotation axis with inner and outer blades producing the same directions of air flow. Fig. Figure 5 shows the section through the axial fan shown in Fig. 4. Fig. 6 is an axonometric view of the fan shown in Fig. 4.

Description of the Embodiments

[0017] The exemplary axial fan shown in Figs. 1, 2 and 3 is provided with a torque source with a fixed part thereof - a stator 1 and a rotating part thereof - a rotor 2 rotating around an axis of rotation 3 in a given direction. Rotor 2 is provided with inner blades 4 with a geometry producing movement of air in one direction 13. Attached to the ends of the inner blades 4 is a rotating ring 5, separating the two coaxial air flows, on the outside of which are fixed outer blades 6 with a geometry producing movement of air in the opposite direction 14 as opposed to one direction 13.

[0018] To the fixed part of the torque source - the stator 1, a static circular shell 8 is rigidly connected by means of four ribs 7 through its inner part, separating two coaxial air flows, to the outer part of which a circular shell 10 is rigidly connected by means of four separating ribs 9 through its inner part, forming the outer, static part, of the axial fan. To the inner part of the circular shell 10, another static circular shell 12, separating two coaxial air flows, is rigidly attached by its outer part behind the outer blades 6 by means of additional separating ribs 11. By appropriately shaping the slit between the rotating ring 5 and the static circular shell 8 and another static circular shell 12, mixing of the two air flows can be substantially eliminated.

[0019] The exemplary axial fan shown in Figs. 4, 5 and 6 is provided with a torque source with a fixed part thereof - a stator 1 and a rotating part thereof - a rotor 2 rotating around an axis of rotation 3 in a given direction, where rotor 2 is connected to the inner blades 4 with a geometry producing movement of air in one direction 13. Attached to the ends of the inner blades 4 is a ring 5, separating the two coaxial air flows, on the outside of which are rigidly fixed outer blades 6 with a geometry producing movement of air in the same direction 15 as one direction 13.

[0020] To the fixed part of the torque source - the stator 1, a static circular shell 8 is rigidly connected by means of at least one rib 7 through its inner part, separating two coaxial air flows, to the outer part of which a circular shell 10 is rigidly connected by means of at least one separating rib 9 through its inner part, forming the outer, static part, of the axial fan. To the inner part of the circular shell 10, another static circular shell 12, separating two coaxial air flows, is rigidly attached by its outer part behind the outer blades 6 by means of at least one separating rib 11. By appropriately shaping the slit between the rotating ring 5 and the static circular shell 8 and another static circular shell 12, mixing of the two air flows can be substantially eliminated.

Industrial Applicability

[0021] The axial fan according to this technical solution finds application wherever the use of two or more separate air streams is required, especially in ventilation, cooling and smoke extraction of residence areas, in the construction industry, manufacturing industry, chemical industry, food industry, metallurgical industry, mining industry, electro technical industry, computer technology and the like.

Claims

1. An axial fan having a stator (1) to which is attached a rotor (2) with at least two blades (4) having a geometry for moving air in a direction (13), **characterised in that** to the ends of the at least two blades (4) is attached a rotating ring (5) on the outer side of which are at least two additional blades (6) and at the ends of the additional blades (6) is located an outer shell (10), wherein a static circular shell (8) is rigidly attached to the stator (1) by at least one rib (7) and connected to the rotating ring (5) by its inner part, to the outer part of which a circular outer shell (10) is rigidly attached by means of at least one separating rib (9) to its inner part, and another static circular shell (12) is rigidly attached by means of at least one additional separating rib (11) to the inner part of the circular shell (10) behind the outer blades (6).

2. An axial fan according to claim 1, **characterised in that** the at least two additional blades (6), by their geometry, provide movement of air in the opposite direction (14) to one direction (13).

3. An axial fan according to claim 1, **characterised in that** the at least two additional blades (6), by their geometry, provide movement of air in the same direction (15) to one direction (13).

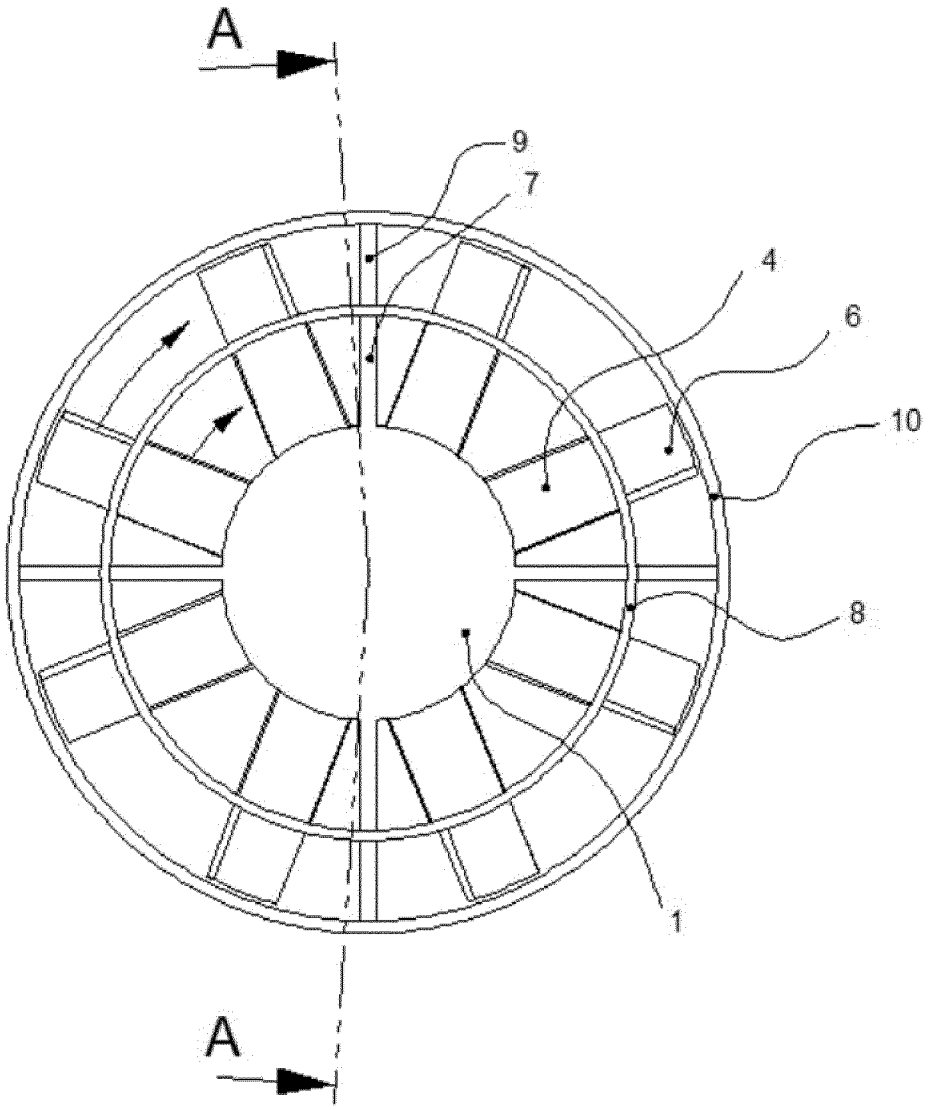


Fig. 1

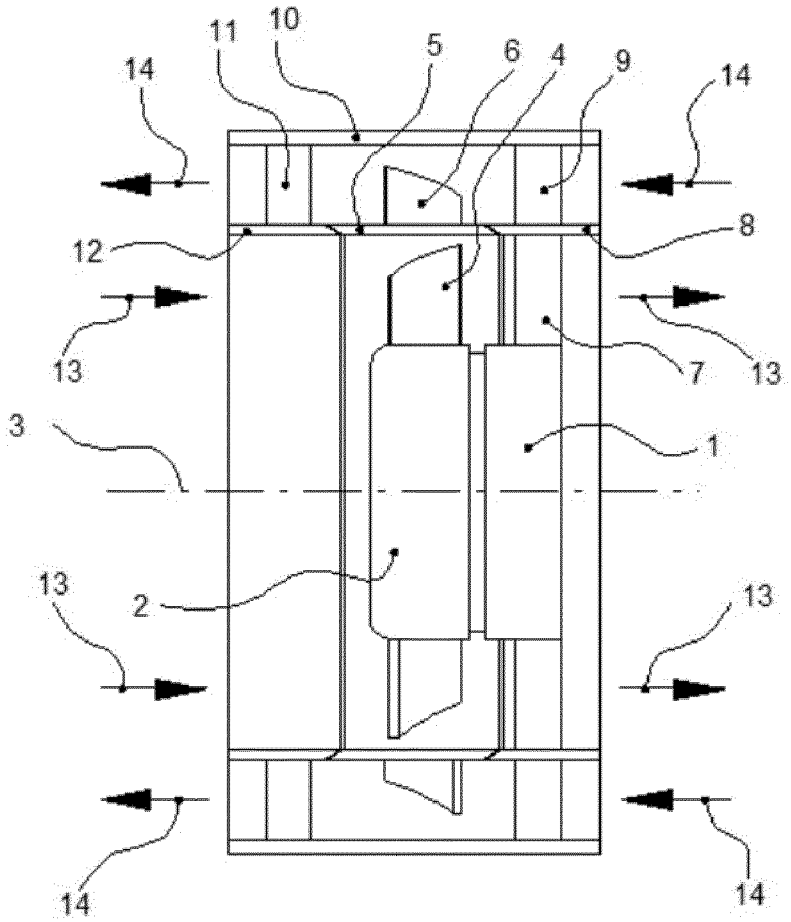


Fig. 2

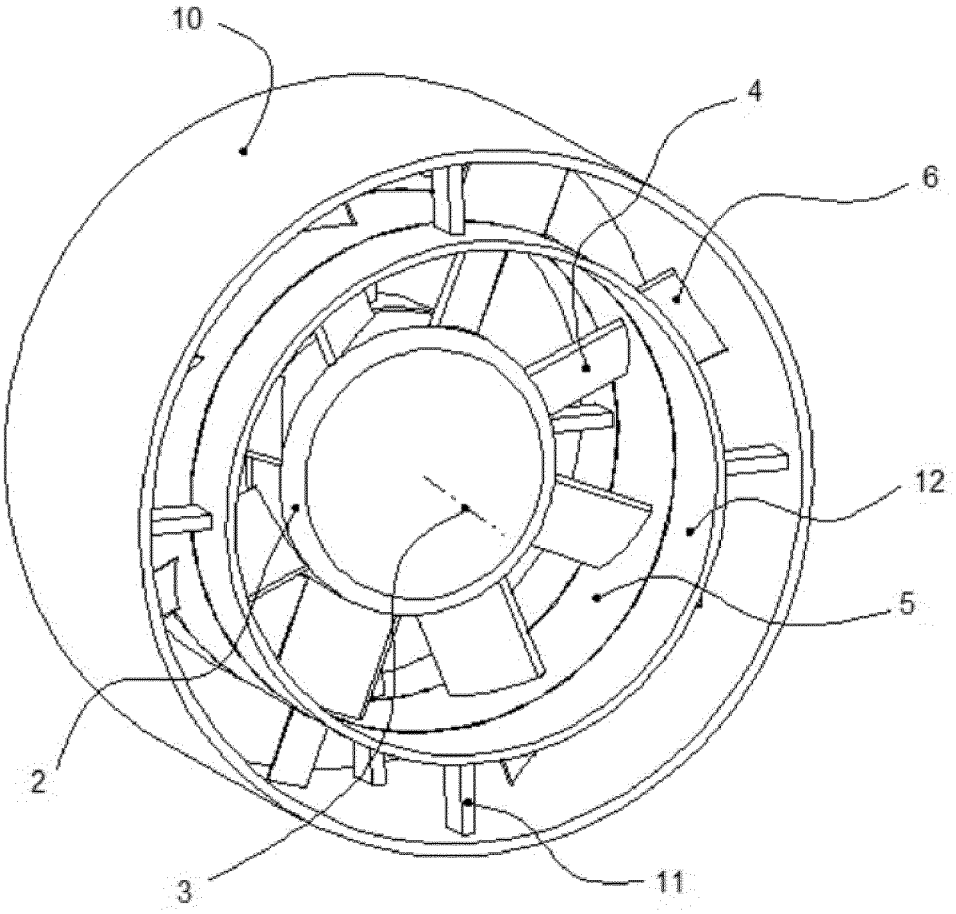


Fig. 3

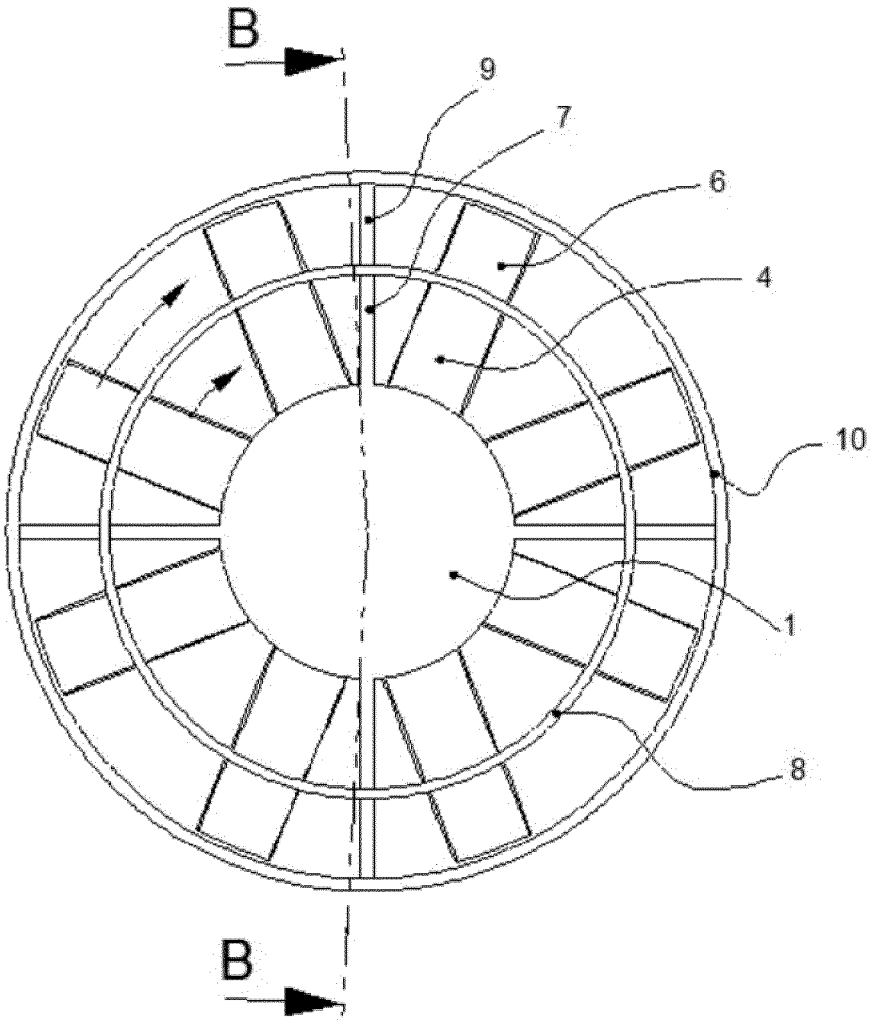


Fig. 4

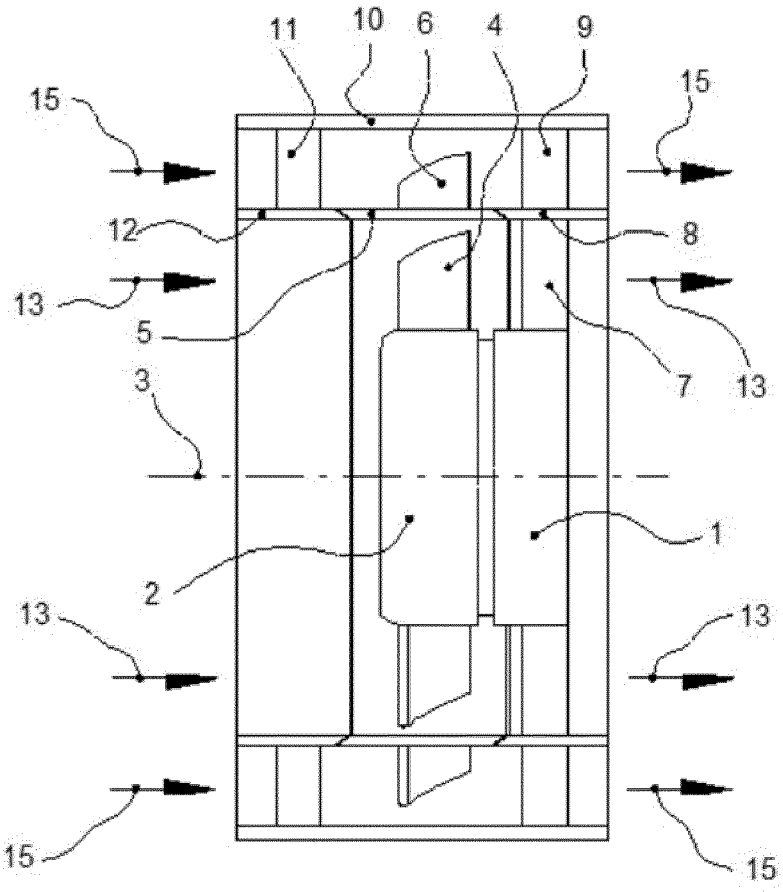


Fig. 5

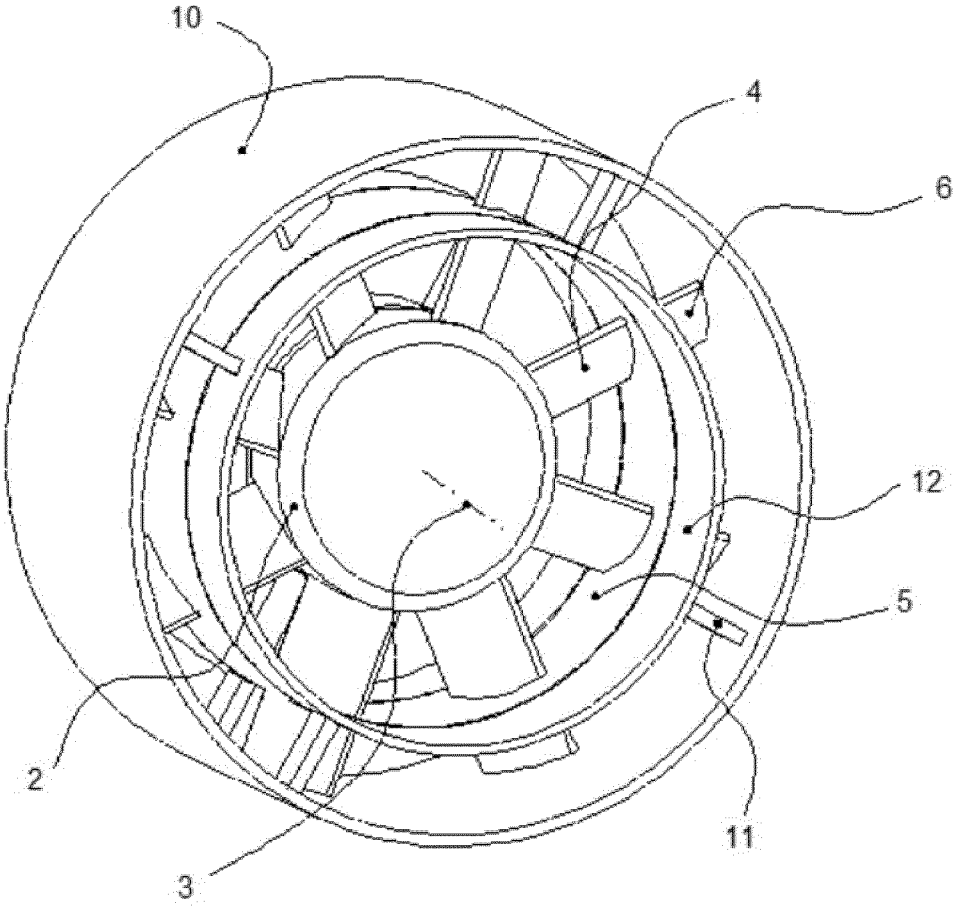


Fig. 6

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EUROPEAN SEARCH REPORT

Application Number
EP 24 20 7918

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	FR 2 300 240 A1 (PIETRACCI SA EXPL BREVETS [FR]) 3 September 1976 (1976-09-03) * figures 1-3 *	1-3	INV. F04D19/00 F04D25/16 F04D29/32 F04D29/38 F04D29/54
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TECHNICAL FIELDS SEARCHED (IPC)

F04D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	14 February 2025	De Tobel, David

CATEGORY OF CITED DOCUMENTS

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